

**Case Report***Copyright © All rights are reserved by Andrea Letanovska*

# Perioperative Management of Patient with IVC Leiomyosarcoma Resection: A Case Report

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Vascular leiomyosarcomas are rare soft tissue sarcomas, primarily affecting the vasculature. Surgical resection remains the cornerstone of treatment for this condition and is currently the only therapeutic approach with the potential for curative outcomes. The procedure is particularly challenging in cases involving the suprarenal segment of the inferior vena cava (IVC), where vascular reconstruction may be necessary. We present a case of a 71-year-old female with an IVC sarcoma located in the suprarenal segment, who underwent successful resection without the use of venovenous intraoperative bypass. The procedure involved total vascular liver exclusion, with suprahepatic and infrarenal IVC clamping. We also report on the hemodynamic changes observed during hepatic vein manipulation and clamping, which were managed pharmacologically. As part of preoperative management, the patient was admitted to the intensive care unit (ICU) and subsequently underwent resection of the suprarenal IVC segment, along with prosthetic replacement, right-sided adrenalectomy, and resection of the first segment of the liver. The surgical technique is detailed later in the manuscript. General anesthesia was administered, combining intravenous agents, inhalational anesthesia, and epidural analgesia. Throughout the procedure, the patient experienced significant circulatory instability, requiring high doses of vasoactive agents and catecholamines. Fluid and vasoactive drug administration were titrated according to semi-invasive hemodynamic monitoring, with appropriate blood loss replacement. At the conclusion of the procedure, the patient was transferred to the ICU for continued analgesia and mechanical ventilation. In the immediate postoperative period, circulatory stability gradually improved, and the dosage of catecholamines was reduced. Given the vascular reconstruction, continuous anticoagulation was initiated, with close monitoring of coagulation status. The patient experienced diffuse bleeding from extensive wound areas, likely due to adhesions from a previous failed tumor resection at another facility. As a result, three subsequent surgical revisions were performed to address the bleeding, although the source could not be identified. During these revisions, temporary administration of catecholamines was again required. Ultimately, the patient's condition stabilized, and she was discharged on the 22nd postoperative day. This represents our first experience in Slovakia with perioperative management of a patient undergoing IVC resection without extracorporeal circulation or cardiopulmonary bypass. The management of such cases requires a multidisciplinary approach to address complex complications and improve patient survival outcomes.

**Keywords:** Vena Cava Inferior; Leiomyosarcoma Resection; Vein Reconstruction; Distribution Shock; Hemodynamic Monitoring; Catecholamines; Angiotensin II

## Introduction

Inferior vena cava (IVC) leiomyosarcoma is a rare and aggressive malignant mesenchymal tumor that originates from the smooth muscle of the venous wall. First described by Perl in 1871, fewer than 400 cases have been documented globally to date [1]. These tumors typically exhibit slow growth, remaining asymptomatic for prolonged periods, and are often diagnosed incidentally. The clinical presentation of IVC leiomyosarcoma is typically delayed and nonspecific, with symptoms varying depending on the affected segment of the vein [2]. Diagnosis is primarily based on imaging studies, with confirmation achieved through biopsy [2]. Historically, involvement of the inferior vena cava has been considered a limiting factor for achieving curative resection in advanced cases [3]. Surgical resection of IVC leiomyosarcoma presents significant challenges, as it requires obtaining clear surgical margins and may necessitate vascular reconstruction. This can be accomplished using prosthetic or autologous grafts, primary suture, or, in some cases, simple ligation of the vena cava without reconstruction [2,4]. It is crucial to carefully assess which patients will benefit from IVC ligation as part of the surgical approach.

## Case presentation

A 71-year-old female patient with a history of leiomyosarcoma involving the inferior vena cava (IVC) and extrahepatic infiltration. The tumor has extended above the renal veins into the hepatic hilum, reaching the confluence of the hepatic veins. Given the extent of the tumor, the patient was deemed a candidate for surgical intervention and subsequently admitted to the intensive care unit (ICU) for perioperative management.

## Medical History

Prior to the onset of the current condition, the patient had a history of grade 2 arterial hypertension, as classified by the ESC/ESH guidelines, with a high cardiovascular risk profile. She also had a documented history of ventricular extrasystole and had undergone colon sigmoidectomy as well as cholecystectomy. In relation to the present diagnosis, the patient underwent partial resection (debulking) of the IVC leiomyosarcoma followed by chemotherapy at another hospital. Her current medication regimen includes Propafenone, Ramipril, and Nadroparin (0.4 mL twice daily). The patient has no known allergies.

## Surgery and perioperative management

Prior to the scheduled surgery, the patient had multiple invasive access lines in place, including a 3-lumen central venous catheter (CVC) via the left subclavian vein, a 2-lumen dialysis CVC via the right internal jugular vein, an epidural catheter, an arterial line, and a permanent urinary catheter. During the procedure for catheter placement, the patient experienced an accidental iatrogenic pneumothorax on the left side following subclavian vein puncture. This was managed with the insertion of chest drainage in the 6th intercostal space, with subsequent air suction from the pleural cavity. The patient then underwent surgery the following day under general anesthesia, after preoperative preparation that included 500 mg of methylprednisolone, a proton pump

inhibitor (PPI), and premedication with Bromazepam. Anesthesia was administered using a combination of Sufentanil, Propofol, Sevoflurane, Ketamine, Atracurium, and epidural analgesia with Levobupivacaine and Sufentanil. The surgical procedure—resection of the suprarenal segment of the IVC with prosthetic replacement, right adrenalectomy, and resection of the first segment of the liver—was successfully performed.

## Surgical Treatment Strategy

The surgical approach was determined based on preoperative CT imaging (Figure 1). Key factors influencing the decision included the involvement of the caudate lobe of the liver and the patency of blood flow within the affected segment of the inferior vena cava (IVC), specifically between the renal and hepatic veins, with only limited collateral circulation observed on imaging. Given these findings, resection without reconstruction was not considered viable. Instead, reconstruction using a ringed PTFE graft was planned. Considering the unpredictable perioperative hemodynamic consequences associated with IVC clamping and total vascular liver exclusion, a preparatory extracorporeal bypass from the infrarenal IVC to the subclavian vein was established, available for use if necessary. Following complete en bloc mobilization of the IVC segment involved by the tumor, the caudate lobe of the liver, and the right adrenal gland—both in close proximity to the tumor (Figure 2)—the IVC was clamped in the suprarenal segment below the tumor. The Pringle maneuver was then performed by clamping the hepatoduodenal ligament, including the portal vein and hepatic arteries, resulting in immediate hemodynamic changes. These changes were successfully managed with pharmacological interventions. As a result, we proceeded with resection without the need for the extracorporeal bypass. Resection and reconstruction were conducted utilizing a 20 mm ringed PTFE graft as an interposition bypass (Figures 3,4). The clamping duration was 40 minutes; following reconstruction of the proximal anastomosis just below the hepatic veins (lasting 15 minutes), blood flow to the liver was re-established, and the suprarenal anastomosis was completed subsequently.

## Perioperative Management

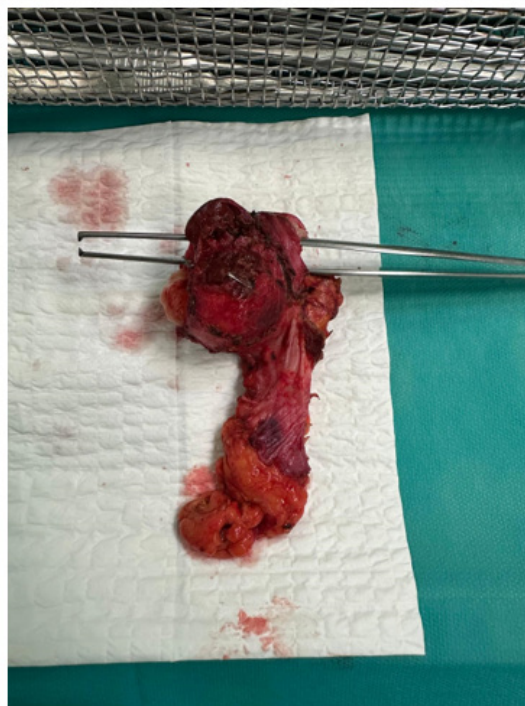
Before IVC clamping, the patient received a heparin bolus at a dose of 100 units per kilogram. Continuous anticoagulation therapy with heparin was maintained in the postoperative period. The overall duration of the procedure was 265 minutes. To manage severe distributive shock during clamping, the patient required administration of a combination of vasopressors and catecholamines. Norepinephrine was administered at high doses, up to 4.00 mcg/kg/min, along with argipressin at 0.03 IU/min, angiotensin II at 40 ng/kg/min, and push-dose epinephrine (2x 100 mcg) to address hemodynamic instability. Additionally, Metoprolol 1 mg was administered to control tachycardia. Vasoactive drugs and fluids were titrated based on semi-invasive hemodynamic monitoring. Blood loss was carefully managed, with transfusions provided as necessary to maintain hemoglobin levels. Fluid balance included a total blood loss of 450 mL, 560 mL of blood products administered, 2550 mL of crystalloid fluids, and a diuresis of 730 mL. Blood glucose was closely monitored and managed with insulin.

At the conclusion of the operation, the patient was transferred to the intensive care unit (ICU) under analgesosedation and mechanical ventilation. Circulatory stability progressively improved, allowing

for a gradual reduction in the dose of catecholamines. Continuous heparin infusion was maintained due to the vascular reconstruction, and coagulation status (APTT) was monitored closely.



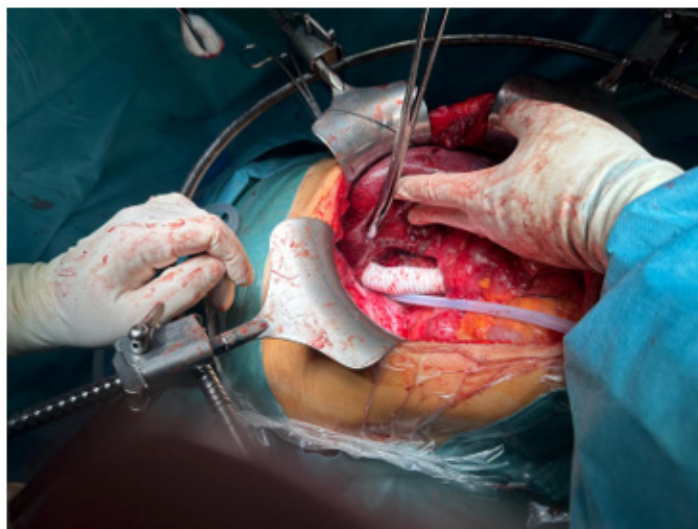
**Figure 1:** Preoperative CT scan which shows tumor of IVC between renal and hepatic veins.



**Figure 2:** Surgical specimen of resected IVC along with caudate lobe of the liver as well as right adrenal gland (tweezers are inserted to resected IVC).



**Figure 3:** Postoperative CT scan which shows patent interposit PTFE graft restoring blood flow after IVC resection.



**Figure 4:** Peroperative picture shows liver afret resection of segment I along with interposit PTFE bypass.

### Postoperative management and treatment at ICU

Upon transfer to the ICU at 1:50 p.m., the patient was sedated, mechanically ventilated, and remained hemodynamically unstable. Bilateral pleural drainage was implemented: on the left side, active suction was applied with a negative pressure of -12 cm H<sub>2</sub>O using a Thopaz device (without air leak), and on the right side, drainage was passive with a Heimlich valve. A postoperative chest X-ray confirmed bilateral pleural effusion without pneumothorax. Over

the next several hours (9:00 p.m.), the patient's circulatory instability deepened, necessitating an increase in the doses of norepinephrine, argipressin, and angiotensin II. Hemodynamic parameters were concerning, with a stroke volume (SV) of 15-25 mL, a cardiac index (CI) of 2.2, and a stroke volume variation (SVV) of 15-25%. A fluid bolus of 500 mL (composed of albumin and crystalloids) resulted in only minimal, transient improvement. Hemoglobin levels dropped appropriately, and an abdominal ultrasound revealed no active bleeding, with blood flow preserved. The patient



experienced reduced diuresis, and echocardiography indicated left ventricular relaxation disorder along with moderate systolic dysfunction. The abdominal drains were outputting small amounts (2x70 mL) of sanguineous fluid. Laboratory results, including lactate, liver enzymes, acid-base balance, and glycemia, remained within acceptable limits. At 11:00 p.m., further deterioration of circulatory status prompted the addition of dobutamine to address impaired left ventricular kinetics. Sinus tachycardia was managed with Metoprolol. Due to persistent instability and oligoanuria, Levosimendan was introduced to augment cardiac function. Subsequent imaging confirmed intra-abdominal bleeding, leading to an emergency laparotomy approximately 12 hours after the initial surgery. After revision of the abdominal cavity, the patient's hemodynamics stabilized, and the use of vasoactive agents was discontinued. Over the following hours, analgesosedation was gradually reduced, and the patient was successfully extubated with the initiation of spontaneous breathing approximately 30 hours post-revision. Post-extubation, the patient exhibited sufficient spontaneous respiration, and the chest drains were removed. Diuresis was fully restored, and there were no signs of infection, though the patient continued on antibiotic therapy. Nutritional support was initiated, and intensive rehabilitation, mobilization, and psychological support were commenced. Subsequently, while undergoing continuous anticoagulation therapy, the patient required two additional abdominal revisions due to continued bleeding, which occurred on the 4th and 8th postoperative days. Both procedures had an uneventful perioperative course. The patient was discharged home on the 22nd postoperative day, where she continues her recovery.

## Discussion

The long-term prognosis for patients with tumors invading the inferior vena cava (IVC) without curative resection is poor. The risk of IVC obstruction syndrome and recurrent pulmonary embolism significantly jeopardizes the patient's life. Surgical resection of these tumors not only mitigates the risk of pulmonary embolism but also alleviates the clinical manifestations of hormonal hypersecretion and reduces the compression of surrounding organs caused by the tumor mass [5]. Total hepatic vascular exclusion (TVE), which involves clamping the portal triad as well as the IVC both above and below the liver, has proven beneficial for the resection of tumors involving both the IVC and the liver. This technique reduces intraoperative bleeding and the risk of air embolism [3]. A bloodless operative field facilitates precise dissection and reconstruction, contributing to a reduction in operation time. Additionally, in patients with chronic IVC obstruction, the development of collateral venous drainage through the ascending lumbar veins and the azygous/hemiazygous system helps mitigate hemodynamic instability during TVE, reducing the likelihood of needing cardiopulmonary or venovenous bypass [6]. However, rapid transfusion protocols and close anesthesiology support are crucial to maintaining stable hemodynamics during the procedure. Once hemodynamic status is stabilized, bypass is typically unnecessary; otherwise, venovenous bypass should be considered. IVC surgery presents significant challenges not

only for the surgical team but also for the anesthesiology team. Manipulation of hepatic vessels and, particularly, clamping of the IVC are critical moments in the procedure. These maneuvers often result in compromised heart filling and reduced cardiac output, leading to severe distributive shock. To manage this, it is essential to administer a combination of vasoactive agents in high doses, alongside careful fluid management based on continuous hemodynamic monitoring. Ultimately, experienced management of severe shock allows successful completion of the procedure without the need for cardiopulmonary bypass.

## Conclusions

Radical surgical resection remains the only potentially curative treatment for patients with leiomyosarcoma involving the inferior vena cava (IVC) [2]. Without resection, the median survival is limited to only one month [7]. Transdiaphragmatic intrapericardial IVC isolation is a simple and efficient technique that provides an option for patients who are not candidates for sternotomy or cardiopulmonary bypass (CPB) [3]. In conclusion, this technique appears to provide several advantages in the surgical treatment of IVC tumors, including the potential for a longer tumor-free margin, reduced operative time, and avoidance of sternotomy and CPB. However, further experience is required to fully validate this approach. From an anesthesiological perspective, managing the perioperative care of patients undergoing such procedures presents significant challenges. In the case we report, extreme circulatory instability was encountered during the isolation of the hepatic vessels and clamping of the IVC. The use of standard vasoactive agents (norepinephrine, argipressin) in unusually high doses, in combination with angiotensin II and targeted fluid management, effectively bridged the critical period of distributive shock without necessitating extracorporeal circulation or CPB. However, inadequate preparation, inappropriate patient selection, poor timing of surgery, and lack of experience in managing severe distributive shock can be fatal [8-11]. Therefore, we emphasize the importance of thorough preoperative preparation, clear communication, and strong teamwork as fundamental components for ensuring successful outcomes.

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## Conflict of Interest

There is no conflict of interest.

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